

What is claimed is:

- 1     1.     An apparatus comprising:  
2             a first phase shifter to provide subcarrier dependent phase shifts to modulation  
3     symbols associated with an orthogonal frequency division multiplexing (OFDM) signal  
4     to generate first phase shifted modulation symbols, wherein said modulation symbols  
5     correspond to subcarriers of the OFDM signal; and  
6             a first inverse discrete Fourier transform unit to convert said first phase shifted  
7     modulation symbols from a frequency domain representation to a time domain  
8     representation.
  
- 1     2.     The apparatus of claim 1, further comprising:  
2             a second phase shifter to provide subcarrier dependent phase shifts to said  
3     modulation symbols associated with said OFDM signal to generate second phase  
4     shifted modulation symbols, wherein said second phase shifter provides different  
5     subcarrier dependent phase shifts to said modulation symbols than said first phase  
6     shifter; and  
7             a second inverse discrete Fourier transform unit to convert said second phase  
8     shifted modulation symbols from a frequency domain representation to a time domain  
9     representation;  
10            wherein said first inverse discrete Fourier transform unit is associated with a  
11   first antenna path and said second inverse discrete Fourier transform unit is associated  
12   with a second antenna path.
  
- 1     3.     The apparatus of claim 2, further comprising:  
2             at least one other phase shifter to provide subcarrier dependent phase shifts to  
3     said modulation symbols associated with said OFDM signal to generate other phase  
4     shifted modulation symbols, wherein said at least one other phase shifter provides  
5     different subcarrier dependent phase shifts to said modulation symbols than said first  
6     and second phase shifters; and

7           at least one other inverse discrete Fourier transform unit to convert said other  
8 phase shifted modulation symbols from a frequency domain representation to a time  
9 domain representation.

1    4.     The apparatus of claim 2, wherein:  
2           said first and second inverse discrete Fourier transform units are fast Fourier  
3 transform (FFT) units.

1    5.     The apparatus of claim 1, wherein:  
2           said first phase shifter provides a phase shift to a first modulation symbol based  
3 on a difference between a frequency of a corresponding subcarrier and a center  
4 frequency of a channel in which said OFDM symbol is to be transmitted.

1    6.     The apparatus of claim 1, wherein:  
2           said first phase shifter provides subcarrier dependent phase shifts to said  
3 modulation symbols based on an approximate coherence bandwidth associated with the  
4 apparatus.

1    7.     The apparatus of claim 1, wherein:  
2           said modulation symbols associated with said OFDM signal includes at least a  
3 first modulation symbol and a second modulation symbol, said first modulation symbol  
4 being associated with a first subcarrier and said second modulation symbol being  
5 associated with a second subcarrier that is adjacent to said first subcarrier in frequency,  
6 wherein said phase shifter provides phase shifts to said first and second modulation  
7 symbols that differ by approximately  $360/B$  degrees, where  $B$  represents an  
8 approximate coherence bandwidth.

1    8.     A method comprising:  
2           acquiring modulation symbols to be used to generate an orthogonal frequency  
3 division multiplexing (OFDM) signal, said modulation symbols including at least a first

4 symbol and a second symbol, wherein said modulation symbols correspond to  
5 subcarriers of the OFDM signal;  
6 applying a first phase shift to said first symbol that is dependant upon the  
7 subcarrier associated with said first symbol to generate a first phase shifted symbol; and  
8 applying a second phase shift to said second symbol that is dependent upon the  
9 subcarrier associated with said second symbol to generate a second phase shifted  
10 symbol.

1 9. The method of claim 8, further comprising:  
2 applying an inverse discrete Fourier transform to a group of modulation symbols  
3 that includes said first phase shifted symbol and said second phase shifted symbol.

1 10. The method of claim 9, wherein:  
2 said modulation symbols to be used to generate said OFDM signal include other  
3 symbols in addition to said first symbol and said second symbol, said method further  
4 comprising applying subcarrier dependent phase shifts to said other symbols to generate  
5 other phase shifted symbols, wherein said group of modulation symbols includes said  
6 other phase shifted symbols.

1 11. The method of claim 8, wherein:  
2 applying a first phase shift to said first symbol includes applying a phase shift  
3 that is linearly related to a frequency of the subcarrier associated with said first symbol.

1 12. The method of claim 8, wherein:  
2 applying a first phase shift to said first symbol includes applying a phase shift  
3 that is non-linearly related to a frequency of the subcarrier associated with said first  
4 symbol.

1 13. The method of claim 8, wherein:  
2 applying a first phase shift to said first symbol includes applying a phase shift  
3 that is related to an approximate coherence bandwidth of a corresponding channel.

1 14. The method of claim 8, wherein:  
2 said first and second phase shifted symbols are to be transmitted from a first  
3 antenna; and  
4 said method further comprises:  
5 applying a third phase shift to said first symbol that is dependant upon  
6 the subcarrier associated with said first symbol to generate a third phase shifted  
7 symbol, wherein said third phase shift is different from said first phase shift;  
8 and  
9 applying a fourth phase shift to said second symbol that is dependent  
10 upon the subcarrier associated with said second symbol to generate a fourth  
11 phase shifted symbol, wherein said fourth phase shift is different from said  
12 second phase shift;  
13 wherein said third and fourth phase shifted symbols are to be transmitted  
14 from a second antenna, said second antenna being different from said first  
15 antenna.

1 15. An apparatus comprising:  
2 an interleaver to separate a serial input stream of modulation symbols into N  
3 spatial streams, where N is a positive integer greater than 1; and  
4 a steering unit to receive said N spatial streams and to steer the associated  
5 modulation symbols into M antenna paths, where M is a positive integer greater than 1,  
6 wherein said steering unit provides subcarrier dependent phase shifts to modulation  
7 symbols associated with at least one of said N spatial streams.

1 16. The apparatus of claim 15, wherein:  
2 said M antenna paths includes at least a first path and a second path; and

3           said apparatus further includes a first inverse discrete Fourier transform unit  
4 within said first path and a second inverse discrete Fourier transform unit within said  
5 second path.

1   17.    The apparatus of claim 15, wherein:  
2           said first and second inverse discrete Fourier transform units are fast Fourier  
3 transform units.

1   18.    The apparatus of claim 15, wherein N equals M.

1   19.    The apparatus of claim 15, wherein N does not equal M.

1   20.    The apparatus of claim 15, wherein:  
2           said apparatus is adapted for use within a multiple input multiple output  
3 (MIMO) based transmitting device.

1   21.    The apparatus of claim 15, further comprising:  
2           a mapper to map input data bits into a serial stream of modulation symbols  
3 based on a predetermined modulation scheme, said serial stream of modulation symbols  
4 for delivery to an input of said interleaver.

1   22.    The apparatus of claim 21, further comprising:  
2           a forward error correction (FEC) coder to encode user data based on a  
3 predetermined error code, said FEC coder to deliver encoded data bits to an input of  
4 said mapper.

1   23.    The apparatus of claim 15, wherein:  
2           said steering unit provides subcarrier dependent phase shifts to modulation  
3 symbols associated with at least two spatial streams, wherein different phase sequences  
4 are used for each of said at least two spatial streams.

1    24.    The apparatus of claim 15, wherein:  
2            said steering unit provides subcarrier dependent phase shifts to modulation  
3    symbols associated with N-1 of said N spatial streams, wherein different phase  
4    sequences are used for each of said N-1 spatial streams.

1    25.    The apparatus of claim 15, wherein:  
2            said steering unit provides subcarrier dependent phase shifts to modulation  
3    symbols associated with each of said N spatial streams, wherein different phase  
4    sequences are used for each of said N spatial streams.

1    26.    A system comprising:  
2            a first phase shifter to provide subcarrier dependent phase shifts to modulation  
3    symbols associated with an orthogonal frequency division multiplexing (OFDM) signal  
4    to generate first phase shifted modulation symbols, wherein said modulation symbols  
5    correspond to subcarriers of the OFDM signal;  
6            a first inverse discrete Fourier transform unit to convert said first phase shifted  
7    modulation symbols from a frequency domain representation to a time domain  
8    representation; and  
1            at least one dipole antenna element to transmit a radio frequency (RF) signal  
2    that includes said time domain representation of said phase shifted modulation symbols.

1    27.    The system of claim 26, further comprising:  
2            a guard interval addition unit to add a guard interval to said time domain  
3    representation of said phase shifted modulation symbols.

1    28.    The system of claim 27, further comprising:  
2            an RF transmitter located between said guard interval addition unit and said at  
3    least one dipole antenna element to generate said RF signal using said time domain  
4    representation of said phase shifted modulation symbols.

1 29. An article comprising a storage medium having instructions stored thereon that,  
2 when executed by a computing platform, operate to:  
3 acquire modulation symbols to be used to generate an orthogonal frequency  
4 division multiplexing (OFDM) signal, said modulation symbols including at least a first  
5 symbol and a second symbol, wherein said modulation symbols correspond to  
6 subcarriers of the OFDM signal;  
7 apply a first phase shift to said first symbol that is dependant upon the subcarrier  
8 associated with said first symbol to generate a first phase shifted symbol; and  
9 apply a second phase shift to said second symbol that is dependent upon the  
10 subcarrier associated with said second symbol to generate a second phase shifted  
11 symbol.

1 30. The article of claim 29, wherein said instructions, when executed by the  
2 computing platform, further operate to:  
3 apply an inverse discrete Fourier transform to a group of modulation symbols  
4 that includes said first phase shifted symbol and said second phase shifted symbol.

1 31. The article of claim 29, wherein:  
2 to apply a first phase shift to said first symbol includes to apply a phase shift  
3 that is linearly related to a frequency of the subcarrier associated with said first symbol.

1 32. The article of claim 29, wherein:  
2 to apply a first phase shift to said first symbol includes to apply a phase shift  
3 that is non-linearly related to a frequency of the subcarrier associated with said first  
4 symbol.

1 33. The article of claim 29, wherein:  
2 to apply a first phase shift to said first symbol includes to apply a phase shift  
3 that is related to an approximate coherence bandwidth of a corresponding channel.